

# Can we avoid future water conflict in northern central Viet Nam?

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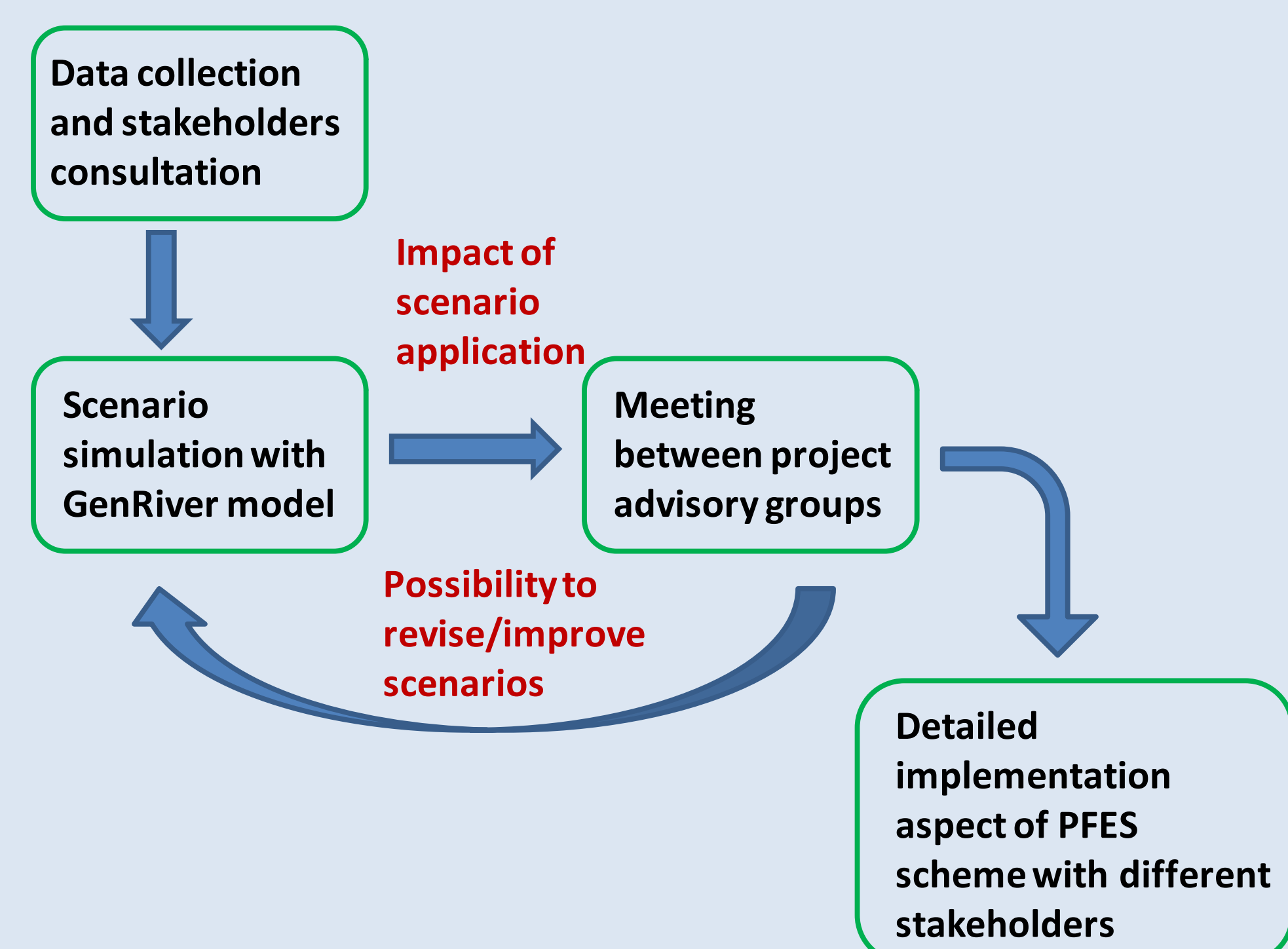
## Issues

- The quantity and quality of water in Ngan Sau river, Ho Ho sub-watershed have been declining since the last decade (2004-2014)
- Less rainfall amount in dry season (May-July) prevents second cropping season. More rainfall in rainy season (August-October) increases intensity of flash flooding

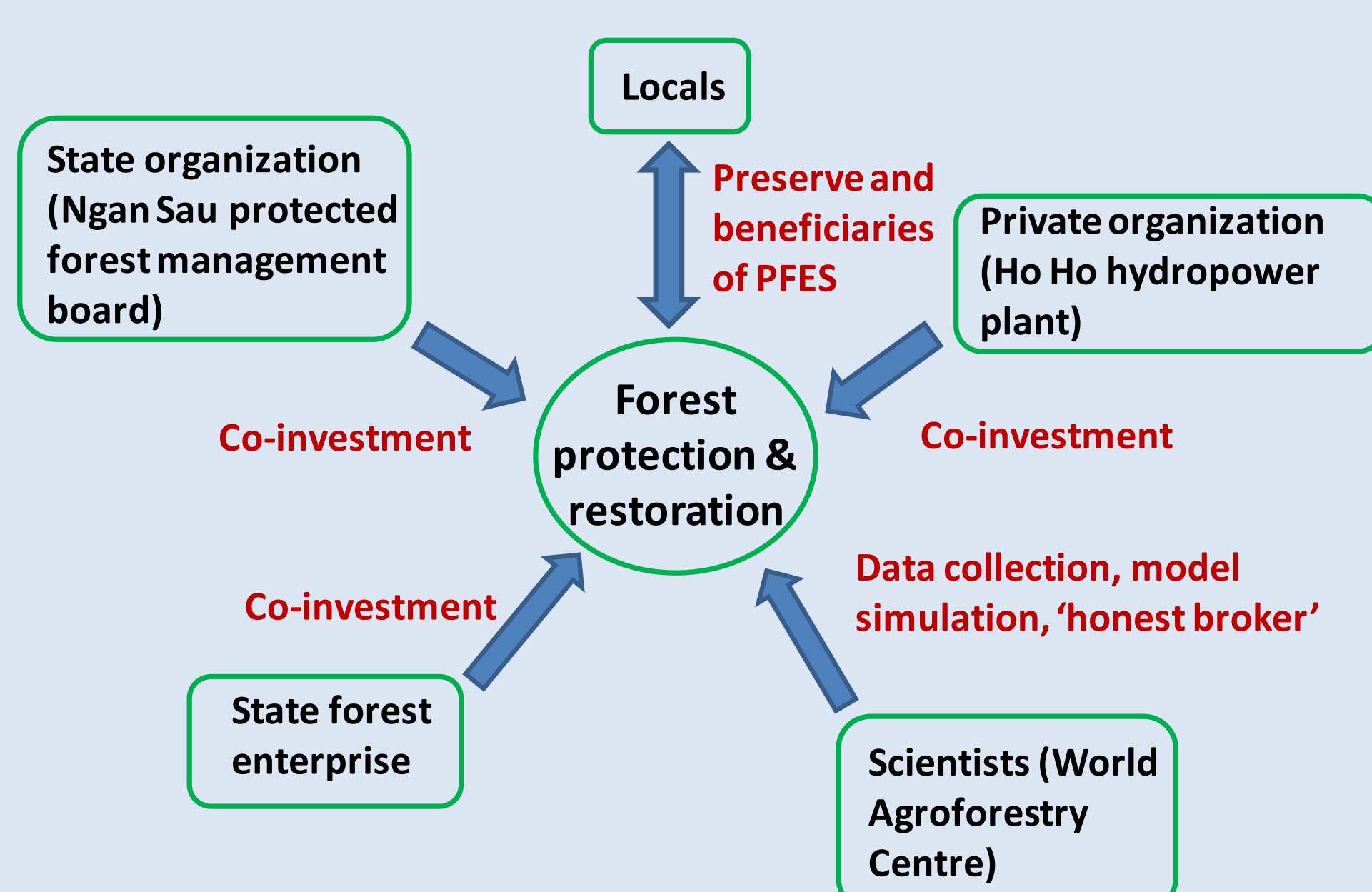
## Study site

- Location: Ho Ho sub-watershed (105° 50' E, 18° 2' N), northern central Viet Nam
- Population in 2014: 3500 households
- Landcover distribution in 2014: 70% logged over forest (natural forest), 7.5% acacia plantation for pulp industry
- Ho Ho dam and hydropower plant operate since 2013, and also supply water to downstream commune

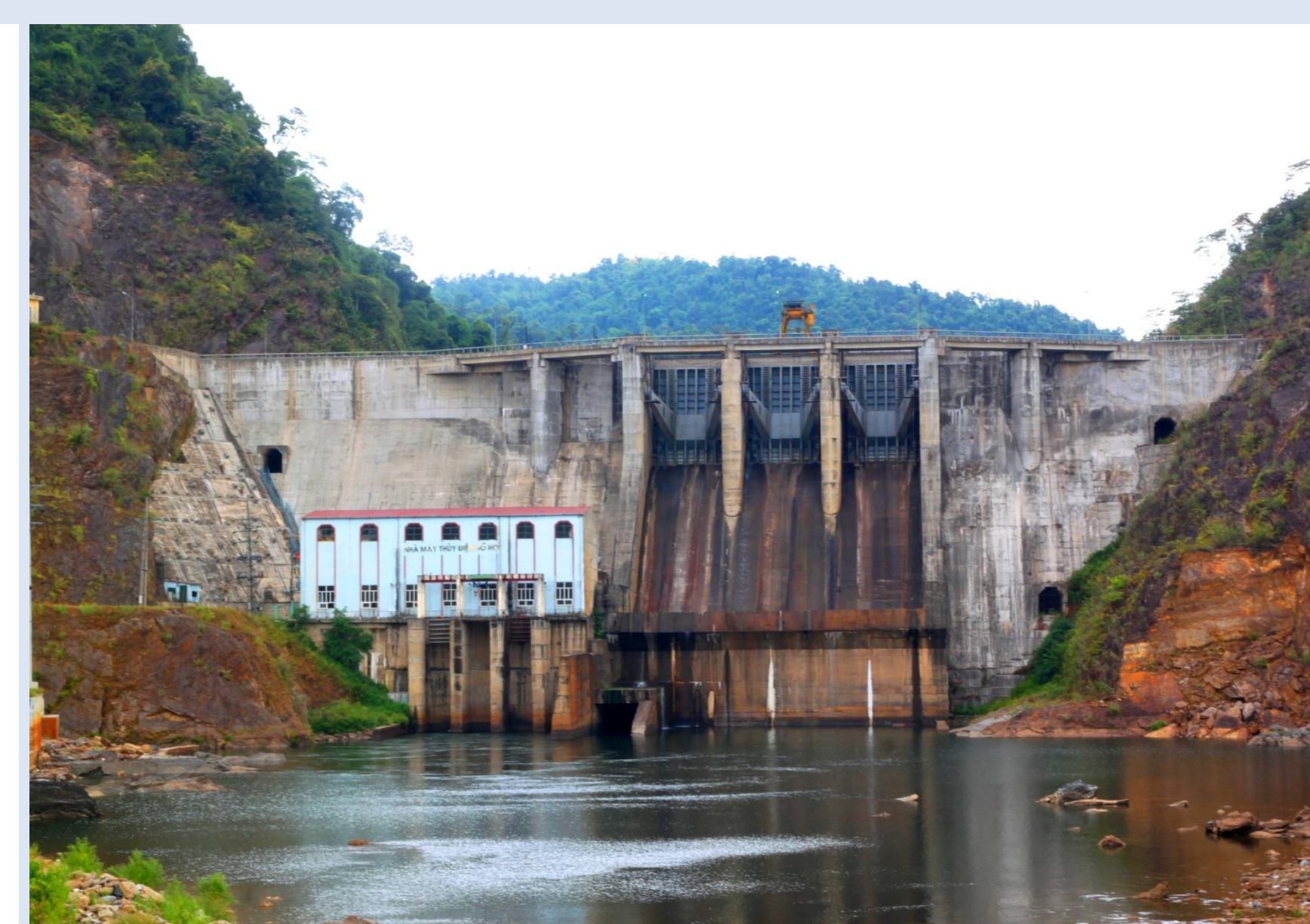
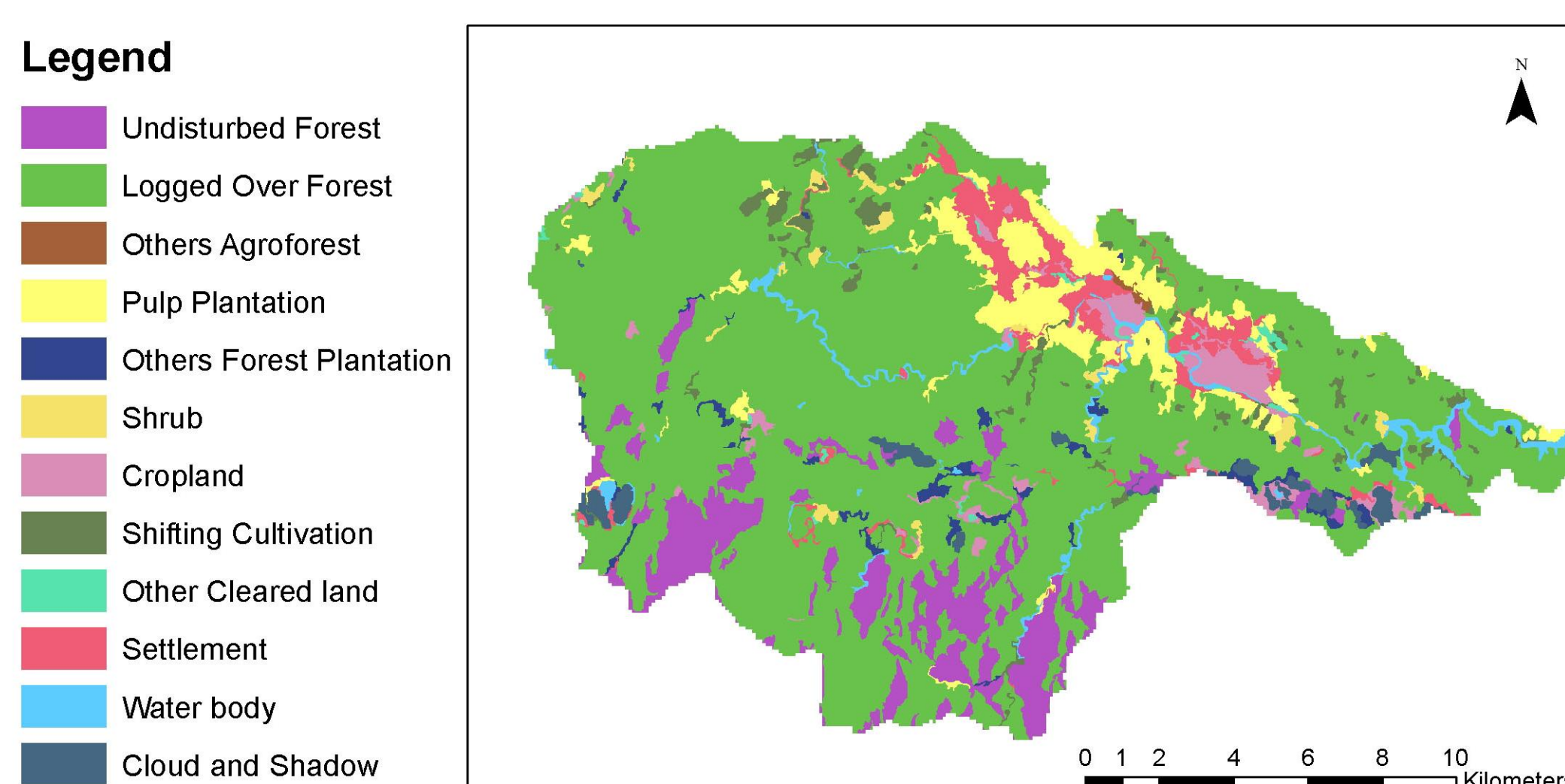
## Rapid hydrological appraisal for developing PFES scheme



All stakeholders call for restoration of poor natural forests especially in upstream to avoid a more severe water scarcity and to reduce flooding intensity



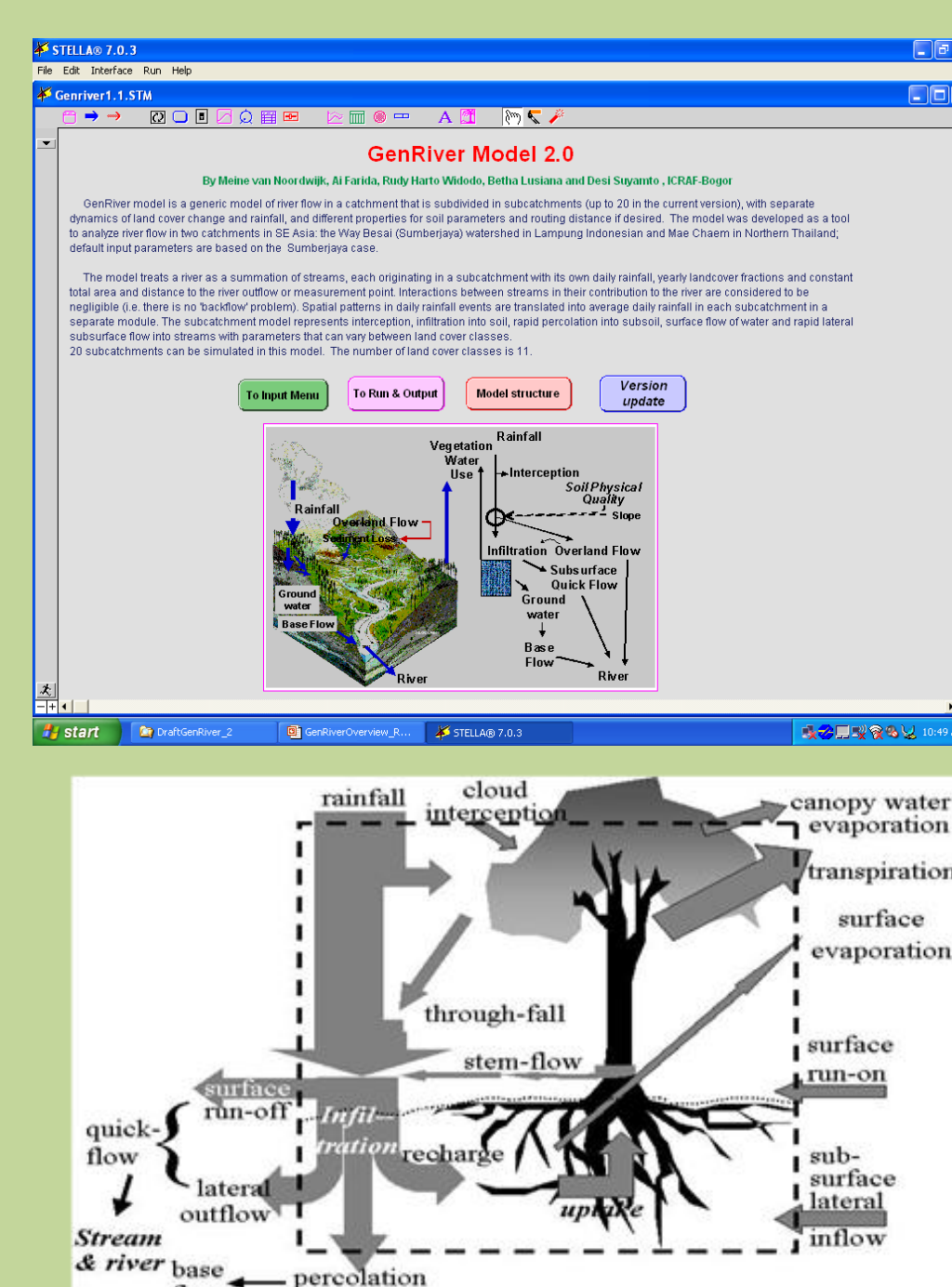
## Landcover in Ho Ho sub-watershed in 2014



Ho Ho dam and hydropower plant, central Viet Nam

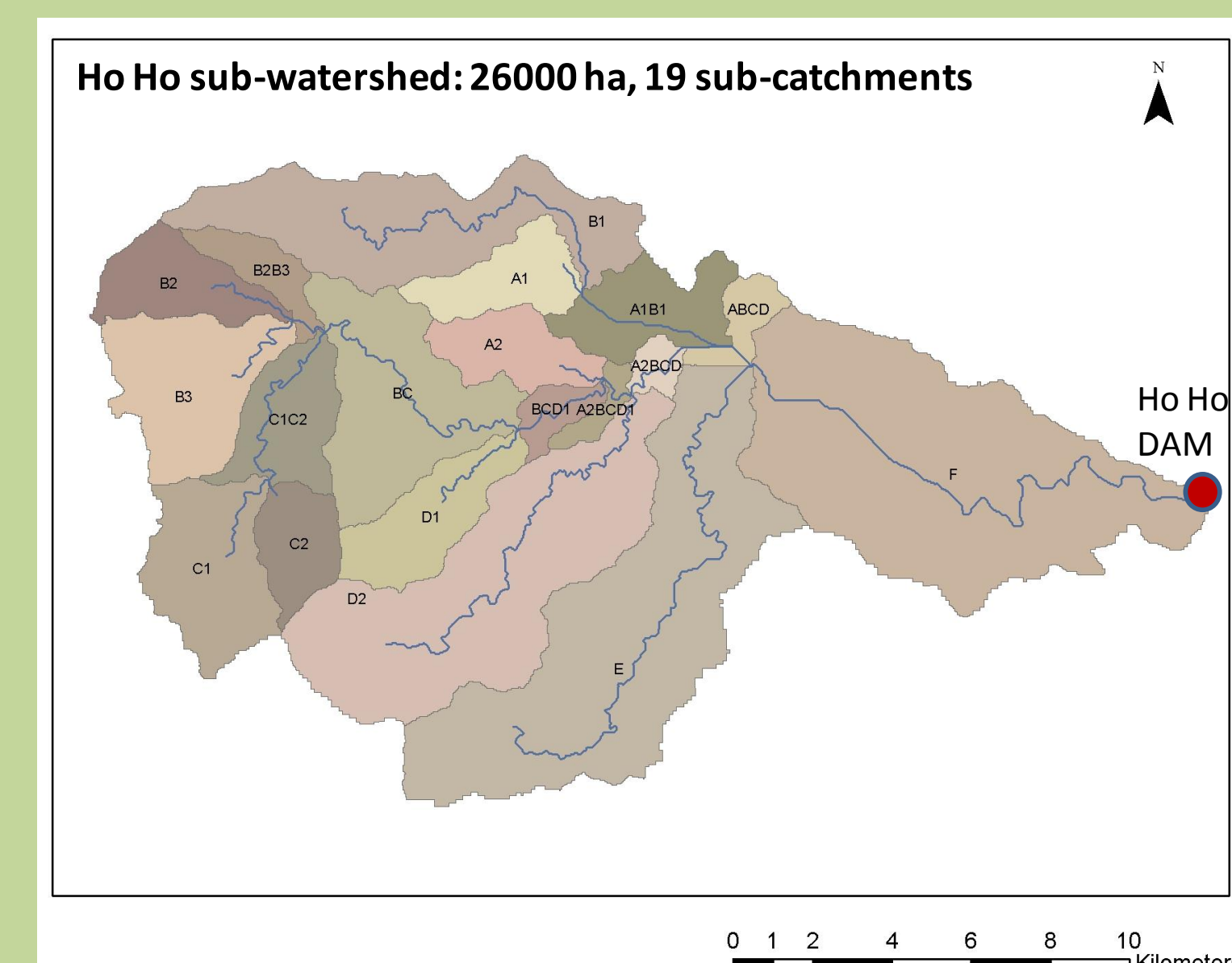
## Model simulations and scenario by GenRiver

We use GenRiver to study impact of forest protection and restoration scenarios to river flow



The model is built in Stella, daily time step, watershed is divided into sub-catchments.

In each sub-catchment, operates water balance routine, the flows are routed to the outlet.



**Source of tributaries**

- A = upper Huang Lam commune
- B = Huang Vinh district/province
- C = Western upstream forest
- D = Southern upstream forest
- E = Thanh Hoa district/province
- F = All upstreams (to final outlet, Ho Ho DAM)

## Model scenarios

- 1 Business as usual**  
Poor natural forest within 3 km distance from main roads and 1 km from river banks will be converted to acacia plantation.
- 2 Forest protection**  
No more conversion of poor natural forests into acacia plantation. Natural regeneration of poor natural forest.
- 3 Forest enrichment**  
No more conversion of poor natural forests into acacia. Planting of indigenous tree species in existing poor natural forests to accelerate forest restoration.

## Model outputs

- Estimated water debit or discharge ( $\text{m}^3 \text{s}^{-1}$ ) for each tributary and final outlet (Ho Ho dam) under different scenarios
- Discharge fraction: total water yield per unit rainfall
- Buffering indicator: the ratio of above-average stream flow and above-average rainfall
- Highest peak flow indicator: maximum flow through a watercourse
- Flow persistence: the fraction of flow on the previous day that can be expected as a minimum volume of river flow on a given day

## Acknowledgement

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